Canada Mortgage and Housing Corporation
Société canadienne d'hypothèques et de logement

CMHC Helping to house Canadians

IMPROVING UPON SURVEY MEASURES OF PHYSICAL HOUSE CONDITION

June 16, 1987

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Improving Upon Survey Measures of Physical House Condition

June 16, 1987

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1.0 INTRODUCTION

1.1 Objectives of the National Housing Study

The 1986 National Housing Study provided CMHC with timely and accurate data on current housing conditions and the nature and extent of home renovation activity in 1985 for a representative sample of Canada's low rise residential stock. This study was one of the most important housing studies ever attempted in Canada. A survey of the current and emerging market for rehabilitation among a representative sample of homeowners, tenants and landlords was conducted to fulfill the crucial policy and evaluation data requirement. The national survey represents the fruition of many years of intensive investigation into the problem of designing and implementing practical, reliable and valid survey methods for this challenging task.

The National Housing Study supplied information in three key areas for subsequent analysis:

i) state of repair of the existing low rise housing stock;

ii) the nature and extent of low rise residential renovation activity in 1985 and underlying determinants and constraints; and

iii) the socio-economic characteristics and building operating costs of publicly-assisted renovators, non-assisted renovators and non-renovators.

The overall rehabilitation and conservation data base will play a vital and recurring role in the areas of program evaluation, market forecasting, and basic research. The survey data base created as a result of this study will be the key empirical ingredient in this broad research agenda.

1.2 Overview of the NHS Survey Methodology

There were two main sources of data for the survey: the building occupant or landlord and the technical

inspector. Occupants (i.e., homeowners and renters) and landlords provided information about their own building, home, apartment, etc. through a self-completed questionnaire. A sub-sample of dwelling units was selected for follow-up technical inspections by fully qualified building experts. The expert data was intended to serve as a comparison and complement to the occupant/landlord data. The analysis of the inspection data is the immediate concern of this follow-up study.

The methodology for the occupant and landlord surveys was based on refinements to telephone and mail survey techniques developed during the course of other major studies conducted for CMHC. The main features of the methodology can be summarised as follows:

- The study population was defined as all owners, renters and landlords of self-contained low-rise dwellings (i.e., four stories or less) in Canada, excluding the Northwest Territories and Yukon.
- The survey was conducted by mail, with separate questionnaires being sent to homeowners, tenants and landlords for self-completion. Reminders and follow-up questionnaires were also sent at scheduled intervals.
- Homeowner and tenant respondents were first contacted by telephone to solicit agreement to receive a questionnaire.
- The sample of telephone numbers for homeowners and tenants was selected with a computerized random-digit generation procedure. Sample stratification ensured a minimum number of respondents in each province.
- Landlords were identified by tenants. Where necessary, additional mailing information was acquired through both supplementary research and direct contact with landlords. The second

landlord questionnaires were delivered by courier.

- All mailing list and survey data were computerized. Each case (i.e., potential respondent) was assigned a unique identifier that permitted tracking through the three waves of the survey. Common elements of the case identifiers also permitted the linkage of tenants and landlords.
- A brief telephone survey was conducted with a sample of non-respondents to provide data to test for bias in the responding sample.

The methodology for the inspection survey was also based on refinements to building inspection techniques and procedures developed over several years in studies conducted for CMHC. A standardised data collection instrument was developed with items concerning building characteristics, physical condition ratings and repair costs. The extent of correspondence between the physical condition ratings of the inspectors and those of the NHS respondents is the primary concern of the analysis conducted for this study.

During the national mail survey, property owners (i.e., landlords and homeowners) were asked if they would be willing to let a CMHC building expert examine their dwelling at some time in the near future. A large number indicated agreement to this proposal (i.e., 31.4 per cent of homeowners and 37.1 per cent of landlords). CMHC staff in the regions and districts across the country subsequently conducted inspections of the dwellings of a sample of these respondents provided by National Office. At the completion of the field work, both survey and physical inspection data was available for subsamples of 1,726 owner-occupied dwellings and 145 rental buildings.

1.3 Objectives of the Inspection Data Analysis

The linkage of survey and inspection data for the owner-occupied and rental dwellings will serve a number of purposes, including:

- providing detailed repair cost data for different types of dwellings;
- providing detailed physical condition ratings, including ratings for mechanical systems for different types of dwellings; and
- permitting comparisons between occupant/landlord survey data and inspector data to be used to validate the occupant/landlord data in the larger survey sample.

The comparison and calibration (and validation) of the physical house condition data from the survey using the inspections data was the main objective of this study. The project had three specific objectives to achieve this end.

1. to create a merged National Housing Study survey/ inspections data file and define the characteristics of the sample of follow-up inspections;
2. to construct summary condition ratings from the inspections data and assess the reliability and validity of the summary and global measures of conditions; and
3. to compare the National Housing Study owner/ occupant summary and global ratings with those of the inspectors and specify the adjustments required to improve the validity of the National Housing Study summary measures of dwelling condition.

The methods and procedures for conducting the analysis to achieve these objectives are described in the appropriate sections of this report.

2.0 INSPECTION SAMPLE CHARACTERISTICS

2.1 Descriptive Profile of the Samples

Of the total sample of property owners, 2,818 homeowners and 362 landlords initially agreed to follow-up visits by a CMHC building expert by indicating their approval on the mail survey questionnaire. The final inspection samples are somewhat less than these numbers for several reasons including: (i) some respondents simply changed their minds; (ii) a convenient time could not be arranged; (iii) no telephone contact could be made; (iv) only rental dwellings for which both the tenant and landlord had agreed were inspected; and (v) the target for homeowners was reached without having to contact all homeowners who agreed to inspections. In part, this was because the drop-out rate for homeowners was less than one-half of the attrition rate for the landlord sample.

The numbers of completed inspections are presented in the following exhibits by province (Exhibit 2.1), by region (Exhibit 2.2) and by respondent group (Exhibit 2.3).

EXHIBIT 2.1
Number of Completed Inspections by Province

Province	Owner-Occupied Dwellings	Rental Buildings
Alberta	205	14
British Columbia	220	17
Manitoba	101	6
New Brunswick	122	4
Newfoundland	107	3
Nova Scotia	191	12
Ontario	220	27
Prince Edward Island	57	8
Quebec	383	44
Saskatchewan	120	10
	1,726	145

EXHIBIT 2.2
Number of Completed Inspections by Region

Region	Owner-Occupied Dwellings	Rental Buildings
Atlantic	477	27
Quebec	383	44
Ontario	220	27
Prairies	426	30
British Columbia	220	17
	1,726	145

EXHIBIT 2.3
Number of Completed Inspection by Respondent Group

Owner-Occupied Dwellings	Rental Buildings	
Homeowners	Matched Landlord/Tenant	Landlord Only
1,726	93	52

2.2 Representativeness of the Sample

Sample bias could have been introduced into the inspection sample in either of two ways. First, only respondents who had agreed to the inspection were contacted, and it was possible that these groups would systematically differ from the respondents who did not agree. Second, property owners absent during the day may not have been able to agree on a mutually acceptable time to meet since inspectors made appointments to inspect buildings at times that corresponded to their normal eight hour work day. We conducted a comparative analysis of the survey samples and the inspection subsamples to ensure that these two possible sources of sampling error did not introduce any undesirable bias. The comparisons between the survey and inspection samples for a number of respondent and building characteristics are presented in Appendix A.1 (for homeowners), A.2 (for tenants) and A.3 (for landlords).

In general, we do not believe that there are any serious problems with sample bias in the inspection subsamples. For homeowners, buildings needing major repairs are slightly overrepresented in the inspection subsample (13.7 per cent vs. 9.5 per cent) as are buildings having renovation work done in 1985 (55.9 per cent vs. 50.0 per cent). Also buildings in British Columbia are slightly underrepresented (12.7 per cent vs. 16.4 per cent), while buildings in Quebec are slightly overrepresented (22.2 per cent vs. 17.9 per cent). Most other differences are trivial. It should be noted that with a sample as large as that for homeowners (i.e., 8,972 for the survey and 1,726 inspections), even substantively trivial differences can be statistically significant. For the purposes of the subsequent analyses, we did not consider it necessary to make adjustments with file weighting procedures.

3.0 RELIABILITY OF INSPECTIONS DATA

Reliability refers to the intersubjective repeatability of results. In other words, will different people get the same results using the same instrument to measure the same subject. The internal consistency of items is another aspect of reliability. Similar items should have similar responses to be internally consistent and, hence, reliable. The question of internal consistency is easy to address through correlation analysis and by computing reliability coefficients for additive indices (for which the correlations are the key elements). Intersubjective repeatability is more difficult to assess in a sample of this type, however, because differences in statistics between sample strata or other criteria may reflect true differences. For example, statistically significant condition ratings between the stock in Quebec and British Columbia may reflect actual housing differences rather than consistency problems in administering the instrument. Without a random distribution of units and inspectors (as in the 1980 Ottawa Pilot) or a precise knowledge of true differences in the stock, we must rely on the related analysis of validity to assess this aspect of data quality.

Reliability analyses were conducted both for individual physical condition ratings and for summary condition scales computed from individual ratings. (Note: The summary condition scales were computed as simple, additive indices, with equal weight being given to each component rating.) Examples of the condition rating questions are presented in Appendix D in the form of a page from each of the homeowner and landlord questionnaires and the inspection instrument. The reliability tests for individual items were conducted using split-halves methods. In these tests, the sample was randomly split in half and

difference of means (e.g., t-tests) were conducted. There should not be statistically significant differences between the randomly assigned halves for reliable items. This method does address the question of the intersubjective repeatability of results, but it cannot be used to target specific criteria for which reliability may be a problem (e.g., regions for which separate training sessions were conducted). The reliability of summary scales was tested by computing the Cronbach's alpha coefficient. This coefficient ranges from zero (totally unreliable) to one (totally reliable). Any coefficient over .8 should be considered as an indicator of a highly reliable index.

In the process of conducting the series of split-halves t-tests, we could not detect any reliability problems with individual items. In other words, the differences between means for each subsample were not statistically significant. Where there was any question the tests were repeated. The Cronbach's alpha coefficients are presented in Exhibit 3.1.A for owner-occupied buildings and Exhibit 3.1.B for rental buildings. The results indicate that the inspector scales are highly reliable for both types of buildings.

EXHIBIT 3.1.A
Reliability Coefficients for Inspector Summary Scales -- Owner-Occupied Buildings

	Number of Items	Cronbach's Alpha
Exterior	13	.94
Interior	11	.95
Mechanical	10	.93

EXHIBIT 3.1.B
Reliability Coefficients for Inspector Summary Scales -- Rental Buildings

	Number of Items	Cronbach's Alpha
Exterior	13	.94
Interior	11	.95
Mechanical	10	.92

4.0 VALIDITY OF INSPECTIONS DATA

Validity refers to the issue of whether a measuring instrument really measures the construct or property it purports to measure. This concern applies to single indicators as well as multiple indicator summary indices. The important consideration about validity tests is that they are intended to help make the correct interpretation of the data. The measurement instrument itself is not validated, but the interpretation of the data arising from a specified procedure. Thus, an instrument may be valid for one kind of phenomenon but not another.

There are three main types of validity; face validity, criterion or predictive validity and construct validity. Face validity is the simplest form of validity test. The technique is based on whether the relationship between a concept and an observed measurement appears to be true. Criterion validity is based on the comparison between an observed measurement and an external or objective standard. This type of validity test will be presented in a later section in which the inspector ratings are used as criteria to test the validity of the occupant and landlord condition ratings. Construct validity is concerned with the extent to which a particular measure relates to other measures in a theoretically derived or logically plausible manner.

A review of the basic descriptive statistics (e.g., mean, standard deviation) for the inspector condition ratings for owner-occupied and rental dwellings did not reveal any unusual patterns or problems. Pearson correlation coefficients were computed for summary indices and global (i.e., overall) ratings (shown in Appendix D.1 and D.2) to ensure that these measures were related in a logically plausible manner. For owner-occupied buildings,

the results of this analysis are presented in Exhibit 4.1. We expected and achieved very high correlation coefficients. The exterior rating correlation coefficient is .874 while the two interior correlation coefficients are .861 and .891 for surfaces and structures, respectively.

EXHIBIT 4.1
Pearson r Coefficients for Correlations Between Inspector Summary Scales and Global Ratings: Owner-Occupied Buildings

	Global Ratings			
Summary Scales	Q.22	Q.48(a)	Q.48(b)	Q.49
Exterior	.874	.776	.806	.850
Interior	.770	.861	.891	.863
Mechanical	.704	.728	.741	.750

Q.22 = Overall Exterior Condition
Q.48(a) = Overall Condition of Interior Surfaces
Q.48(b) = Overall Condition of Interior Structures
Q.49 = Overall Interior and Exterior Condition

The Pearson correlation coefficient between inspector summary indices and global ratings for rental buildings were also high, although generally they were slightly less than for owner-occupied dwellings. The findings are presented in Exhibit 4.2.

From this limited analysis we did not find any results to suggest validity problems with the inspections data. More detailed criterion validity tests can be conducted by comparing individual and summary condition ratings with repair cost data. However, such an analysis was beyond the mandate of this study.

EXHIBIT 4.2
Pearson r Coefficients for Correlations Between Inspector Summary Scales and Global Ratings: Rental Buildings

	Global Ratings			
Summary Scales	Q.22	Q.48(a)	Q.48(b)	Q.49
Exterior	.817	.693	.769	.817
Interior	.888	.808	.890	.881
Mechanical	.735	.700	.744	.745

Q.22 = Overall Exterior Condition
Q.48(a) = Overall Condition of Interior Surfaces
Q.48(b) = Overall Condition of Interior Structures
Q.49 = Overall Interior and Exterior Condition

5.0 COMPARISON OF INSPECTOR AND RESPONDENT PHYSICAL CONDITION DATA

The analysis of the comparison between inspections data and respondent-supplied physical condition data proceeded in two ways. First, we conducted criterion validity tests of the survey respondent data by computing individual condition item Pearson r correlation coefficients between the inspector and respondent ratings. Second, we analysed how the summary condition ratings varied between the inspectors and survey respondents. To conduct this analysis we standardised the inspector and respondent ratings on a zero to 100 index, computed difference scores for each case, and conducted analyses of variance by key respondent characteristics such as region, tenure, value of dwelling, etc..

5.1 Criterion Validity Tests

5.1.1 Owner-Occupied Buildings

In order to gain an in-depth profile of actual housing conditions, the condition rating scales on the inspections instrument were more numerous and more detailed than on the homeowner mail survey instrument. Therefore, although there are very few identical items on the two instruments for which direct comparisons can be made, there are many similar items which are logically related. It should be noted that cases with missing data for one or more of the individual scales were excluded from the computation of summary indices. The net result was a lower sample size for analyses using the summary indices.

The results of correlational analyses which test for the strength and significance of these relationships are presented in Exhibit 5.1.A for exterior condition ratings, in Exhibit 5.1.B for interior condition ratings, and in Exhibit 5.1.C for mechanical system ratings. All the

EXHIBIT 5.1.A
Pearson r Coefficients for Correlations Between Homeowner Exterior Condition Ratings and Appropriate Inspector Ratings

Homeowner	Inspector		
	Surface Drainage (Q.9)	Lot (Q.10)	
Sitework	.162	.279	
	Foundation Walls (Q.11)	Surface Ext. Walls (Q.13)	Structure Ext. Walls (Q.14)
Outside walls	.257	.419	.323
	Roof Surface (Q.18)	Roof Structure (Q.19)	Flashing (Q.20)
Roof	.420	.298	.298
	Chimney (Q.15)		
Chimney	.325		
	Doors and Windows (Q.16)		
Doors, Windows	.413		
	Attached Structures (Q.8)		
Attached structures	.395		

Note: All coefficients are significant with $p \leq .01$

EXHIBIT 5.1.B
Pearson r Coefficients for Correlations Between Homeowner Interior Condition Ratings and Appropriate Inspector Ratings

Homeowner	Inspector			
	Basement Floor (Q.23)	Surface of Floors (Q.43)	Structural Grd. Floor (Q.44a)	Structural All Floors (Q.44b)
Flooring	.158	.328	.296	.275
	Foundation Walls (Q.24)			
Wall Surfaces	.279			

Note: All coefficients are significant with $p \leq .01$

EXHIBIT 5.1.C
Pearson r Coefficients for Correlations Between Homeowner Mechanical System Condition Ratings and Appropriate Inspector Ratings

Homeowner	Inspector			
	Wiring (Q.34)	Electrical System (Q.35)		
Electrical	.281	.295		
	Furnace Walls (Q.38)	Heat Distribution System (Q.31)		
Heating/Cooling	.275	.230		
	Water System (Q.36a)	Plumbing (Q.36b)	Bathroom Equipment (Q.38)	
Plumbing	.297	.302	.302	
	Insulation Package (Q.28)			
Insulation	.357			

Note: All coefficients are significant with $p \leq .01$

correlation coefficients presented are moderately strong, in the correct direction and statistically significant. This evidence supports our conclusion that the homeowner data are valid measures of physical house condition.

5.1.2 Rental Buildings

A similar correlational analysis for tenant/landlord and inspector condition ratings was also conducted as a criterion validity test for the survey ratings. The results are presented for exterior condition ratings in Exhibit 5.2.A, for interior condition ratings in Exhibit 5.2.B, and for mechanical system ratings in Exhibit 5.2.C.

The correlation coefficients for the exterior ratings are somewhat lower than for owner-occupied dwellings, but most are still acceptable, being moderately strong, in the right direction and statistically significant. However, for the interior and mechanical system ratings the results indicate a problem. Many of the correlation coefficients are lower than, and inconsistent with, our expectations and we suspect that the difficulty is not primarily a validity problem. A reliability problem concerning the consistency of rating items may be a factor. Inspectors were to rate both the interior of the tenants' unit and the common areas of the building. However, it may be that inspectors varied in their approach to rating condition (e.g., with some emphasising the tenants' unit, others the common areas and some blending the ratings). Tenants would have rated only their own unit while landlords might have rated the entire building.

Further tests were conducted to explore this problem. Correlational analyses were performed for sub-samples of the rental building sample based on three key variables; dwelling type (single, semi-detached, row or duplex versus apartment or other type), length of tenure (more

EXHIBIT 5.2.A
Pearson r Coefficients for Correlations Between Landlord and Tenant Exterior Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector		
	Surface Drainage (Q.9)	Lot (Q.10)	
Sitework-landlord	.165*	.198**	
	Foundation Walls (Q.11)	Surface Ext. Walls (Q.13)	Structure Ext. Walls (Q.14)
Outside walls-landlord	.101	.302**	.303**
	Roof Surface (Q.18)	Roof Structure (Q.19)	Flashing (Q.20)
Roof-landlord	.280**	.217**	.175*
	Chimney (Q.15)		
Chimney-landlord	.372**		
	Doors and Windows (Q.16)		
Doors, Windows-landlord	.200**		
	Attached Structures (Q.8)		
Attached structures-landlord	.262**		
	Overall Exterior (Q.22)		
Overall exterior-tenant	.212*		

Note: * Coefficients are significant with $p \leq .05$
** Coefficients are significant with $p \leq .01$

EXHIBIT 5.2.B
Pearson r Coefficients for Correlations Between Landlord and Tenant Interior Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector		
	Surface of Floors (Q.43)	Structural Grd. Floor (Q.44a)	Structural All Floors (Q.44b)
Flooring-landlord	.109	.045	.036
-tenant	.184*	.079	.021

EXHIBIT 5.2.C
Pearson r Coefficients for Correlations Between Landlord and Tenant Mechanical System Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector		
	Wiring (Q.34)	Electrical System (Q.35)	
Electrical-landlord	.140*	.032	
-tenant	.167	.068	
	Furnace (Q.38)	Heat Distribution System (Q.31)	
Heating/Cooling - landlord	.138	.143*	
- tenant	-.026	.168	
	Water Supply System (Q.36a)	Plumbing (Q.36b)	Bathroom Equipment (Q.38)
Plumbing-landlord	.111	.085	.141*
-tenant	.122	.172	.092
	Insulation Package (Q.28)		
Insulation-landlord	.185*		
-tenant	.190*		

Note: * Coefficients are significant with $p \leq .05$

or less than two years) and sample characteristics (i.e., whether the building had both the building and unit inspection or just the building inspection). The results of these analyses are presented in Appendix B.1.A through B.3.B. Although there are many significant differences in this extensive set of correlations, we have not established any consistent pattern that would allow us to draw conclusions about the validity of the data. Reliability problems resulting from inconsistent administration of the instrument are still a distinct probability. We also know from previous studies that renters do not rate items as accurately as do homeowners. The small number of cases constrains us from conducting further and more detailed analysis to determine the precise cause of this problem.

5.2 Analysis of Difference Scores for Owner-Occupied Summary Condition Indices

5.2.1 Computing Standardised Indices

To provide a comparable and meaningful unit of measurement for the overall condition indices for both the inspectors and homeowners, we standardised the four indices (i.e., interior, exterior, mechanical systems and overall condition) to a base of 100 which bounded the indices by zero and 100. This was accomplished by using the following formula:

$$\text{Standardised Index} = \left(\frac{\text{original score}}{\text{theoretical maximum value}}\right) \times 100$$

The distributions of the inspection scores for the four standardised summary indices will be presented in the next section where they will be compared with the predicted index scores from regression models using occupant data as independent variables.

5.2.2 Correlations Between Homeowner and Inspector Summary Condition Indices

Before conducting the analysis of difference scores for condition indices, we computed Pearson correlation coefficients for the homeowner and inspector summary condition indices to test for the strength of the associations and the corresponding levels of significance. The results are presented in Exhibit 5.2.D. These correlations serve as criterion validity tests for the homeowner condition ratings. The strength of the correlations represents the degree of correspondence between homeowners and inspector ratings, and hence the validity of homeowner data.

EXHIBIT 5.2.D
Pearson Correlation Coefficients for Homeowner and Inspector Summary Condition Indices

	Exterior Condition	Interior Condition	Mechanical Systems Condition	Overall Condition
All Homeowners	.459	.296	.332	.364
	(1,034)	(784)	(1,177)	(451)
	$p \leq .001$	$p \leq .001$	$p \leq .001$	$p \leq .001$
Renovators	.466	.292	.299	.387
	(584)	(467)	(664)	(269)
	$p \leq .001$	$p \leq .001$	$p \leq .001$	$p \leq .001$
Non-Renovators	.446	.282	.352	.313
	(418)	(294)	(472)	(170)
	$p \leq .001$	$p \leq .001$	$p \leq .001$	$p \leq .001$

Note: The number in brackets represents the sample size.

5.2.3 Breakdown of Standardised Condition Scores by Need for Repair

For the purposes of testing the validity of the four standardized indices based on inspector ratings, we conducted an analysis of variance using the inspector ratings on the need for repair question as the criterion

variables. The breakdowns of the four standardised condition indices by the three need for repair categories are presented in Exhibit 5.3. Both the means and standard deviations are presented.

For all four indices, the scores are logically related to the need for repair categories and the differences in means between the categories are statistically significant.

EXHIBIT 5.3
Breakdowns of Standardised Inspector Condition Indices by Inspectors Rated Need for Repair

	Yes-Major Repairs		Yes-Minor Repairs		No-Regular Maintenance	
	$\bar{x}$	Std. Dev.	$\bar{x}$	Std. Dev.	$\bar{x}$	Std. Dev.
Exterior Standard Score	61.6	11.4	71.4	9.9	80.4	10.2
Interior Standard Score	63.3	11.0	72.2	10.7	81.4	11.5
Mechanical Systems Standard Score	65.0	11.7	73.5	10.0	80.7	11.0
Overall Condition Standard Score	63.5	9.7	70.7	9.5	79.7	11.1

5.2.4 Analysis of Difference Scores

For each case, and for each of the summary indices, a difference score was computed by subtracting the homeowner score from the inspector score in the following manner:

Difference Score = Inspector Score - Homeowner Score.

If the occupant and inspector ratings were equal, the difference score would be zero. If the occupant score was

higher the difference score would be negative. Conversely, if the occupant score was lower the difference score would be positive.

The comparison of the overall scores for all four indices showed that the homeowners provided significantly higer ratings than the inspectors. In other words homeowners, on average, rated their dwelling as being in better condition than did the inspectors.

To test for the extent of the over or under-estimation of the homeowner ratings, we performed breakdown analyses and analysis of variance using some key house and household characteristics as criterion variables. These included house location (i.e., province and region), need for repair, language, education level, and employment status. These analyses were performed separately for renovators (1985) and non-renovators, as well as for all homeowners. The results of this analysis for all homeowners are presented in Exhibits 5.4.A (exterior condition), 5.4.B (interior condition), 5.4.C (mechanical systems) and 5.4.D (overall condition). Only statistically significant results are presented. The corresponding analyses for renovators and non-renovators are presented in Appendices C.1 and C.2, respectively.

The patterns for the four summary indices are similar. The two variables for which there are consistent and meaningful differences are region and need for repair. There are also statistically significant differences on exterior and interior condition scores for the two language groups, but these differences are not large and we do not consider them to be important.

For three of the summary indices (i.e., excluding exterior condition) the difference scores are consistently higher for the Atlantic, Quebec and Prairie regions than for the rest of Canada. The average scores for these regions

are also negative, meaning that homeowners generally noted the condition of their building more highly than did the inspectors. Ontario scores are always the highest (although they are also negative for three of four items), while the scores for British Columbia are between those for Ontario and the other regions.

These significant variations in the difference scores by region were deserving of further analysis. We could not see a logical reason why, for instance, homeowners in the Atlantic or Prairies would consistently rate their houses ti be in better condition than would the inspectors, while the ratings by Ontario residents were generally in line with the inspector ratings. One possible explanation was that there were real differences in the overall quality of the stock. This might result in some inconsistency, as the breakdowns of differerence scores on the need for repair question shows. Differences in other variables such as dwelling age or average value of the dwelling could also have been factors.

We conducted more detailed tests of the differences that could be attributed to the regions by using analyses of variance. The results of these analyses were that approximately 50 per cent of the difference score variations were explained by region, even when controlling for (i.e., net of the effects of) other variables such as condition of the stock (i.e., need for repair), dwelling age, dwelling size, selling price of the dwelling, income and several other test variables.

Our conclusion is that regional differences in inspector scores reflect a reliability problem and are the result of different interpretations by inspectors of the procedures for rating physical condition. In other words, the same dwelling might have rated a 50 by inspectors in one region (on the standardised index) and 55 by inspectors in

another region. We should note that these differences do not affect the internal consistency of ratings. The comparative rankings of houses within regions are not affected by this variation. However, the ability to make precise comparisons between regions on a single comprehensive measure is somewhat jeopardised by this source of unwanted bias. A means of statistically controlling for this bias is presented in the next section of this report.

With breakdowns by the inspector-rated need for repair question[1], the difference scores for houses needing major or minor repairs are generally small. However, for houses needing only regular maintenance, the difference scores for all four indices are larger. They are also negative indicating that owners of houses in relatively better condition (i.e., need regular maintenance only), have given higher condition ratings on the seven point scales than the inspectors. This pattern is encouraging given that the stock needing repair is of greatest concern to CMHC. Relatively greater accuracy on the part of the homeowner for houses in need of repair is much more important than inaccuracy for houses in need of only regular maintenance.

The differences between inspector and homeowner summary ratings are greater for the overall condition rating than for the other three summary condition indices. There may have been some systematic bias introduced because of the listwise deletion of missing cases (i.e., the deletion of a case from the analysis of summary indices if one or more individual items were missing) because we cannot be certain that the characteristics of missing cases are the same as for non-missing cases. However, this has not been tested.

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[1] This three category question is identical to the version used on the HFE survey and includes categories for major repair need, minor repair need and needs regular maintenance only. Both the inspector and survey respondents completed this question for each dwelling. The breakdowns presented in this text are based on the inspector ratings.

EXHIBIT 5.4.A
Comparison of Scores for Owner-Occupied Buildings: Exterior Condition

	Inspector Score	Homeowner Score	Mean Difference Score	n
Overall	74.23	79.69	-5.78	1,034
Region				
Atlantic	69.70	77.67	-8.02	235
British Columbia	75.81	80.13	-4.46	167
Ontario	80.21	80.49	-0.47	133
Quebec	77.80	81.88	-3.88	225
Prairies	71.22	79.47	-8.80	274
Need for Repair				
Yes -- major repairs	64.01	62.45	1.68	116
Yes -- minor repairs	70.33	72.09	-1.48	217
No -- regular maintenance	77.69	85.95	-8.40	683
Language				
English	73.11	79.03	-6.39	806
French	77.85	82.28	-3.63	228

EXHIBIT 5.4.B
Comparison of Scores for Owner-Occupied Buildings: Interior Condition

	Inspector Score	Homeowner Score	Mean Difference Score	n
Overall	75.27	81.11	-5.69	784
Region				
Atlantic	71.52	78.65	-8.48	220
British Columbia	78.86	80.31	-1.76	89
Ontario	84.41	81.32	3.13	149
Quebec	78.07	85.68	-8.05	121
Prairies	69.56	80.03	-9.42	205
Need for Repair				
Yes -- major repairs	66.31	65.29	1.79	95
Yes -- minor repairs	72.75	74.96	-3.28	158
No -- regular maintenance	77.94	86.67	-7.83	516
Language				
English	74.71	79.84	-5.21	663
French	78.09	85.81	-8.33	121

EXHIBIT 5.4.C
Comparison of Scores for Owner-Occupied Buildings: Mechanical Systems Condition

	Inspector Score	Homeowner Score	Mean Difference Score	n
Overall	75.56	83.95	-7.18	1,177
Region				
Atlantic	68.41	82.47	-12.31	254
British Columbia	78.01	83.73	-4.18	161
Ontario	83.01	83.17	-0.17	172
Quebec	77.99	87.72	-8.15	217
Prairies	74.91	82.55	-7.64	373
Need for Repair				
Yes -- major repairs	67.76	68.91	1.44	140
Yes -- minor repairs	72.82	78.83	-4.84	264
No -- regular maintenance	78.50	88.97	-9.69	740

EXHIBIT 5.4.D
Comparison of Scores for Owner-Occupied Buildings: Overall Condition

	Inspector Score	Homeowner Score	Mean Difference Score	n
Overall	73.96	81.78	-7.34	451
Region				
Atlantic	70.72	80.35	-9.84	98
British Columbia	77.39	81.15	-3.86	65
Ontario	81.93	82.17	-0.98	84
Quebec	77.05	84.74	-8.07	55
Prairies	69.83	81.11	-10.51	149
Need for Repair				
Yes -- major repairs	66.46	65.53	2.96	51
Yes -- minor repairs	70.39	74.42	-4.44	79
No -- regular maintenance	76.57	87.27	-9.74	314

6.0 PREDICTION OF INSPECTOR CONDITION SCORES USING OCCUPANT DATA

6.1 Overview of Regression Analyses

The idea underlying multiple regression analysis is to predict or explain a specific, dependent variable as a function of several independent variables. For example, in this analysis we wanted to predict inspector condition ratings using only occupant data. This would allow us to then go back to the larger survey samples and improve the occupant ratings (i.e., make them closer to the inspector ratings) by using house and household characteristics data as well as occupant condition ratings.

For the study, summary measures of inspector ratings of exterior condition (EXTER), interior condition (INTERIOR), mechanical systems (MECHAN) and overall condition (OVERALL) were explained using regression models. The objective was to develop predictive models using only occupant data as independent variables so that the models could be applied to the larger survey samples.[1] Here we briefly describe the models and some of the assumptions underlying the analyses.

The regression models are linear (i.e., straight line) additive in form, and stepwise or iterative. The best fit is defined in terms of least squared error. The quality or fit of a model can be loosely derived by examining the

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[1] An alternative approach would be to develop regression models to explain the <u>difference</u> between the summary inspector and respondent ratings. The corrective formulas would then take the sum of the respondent rating and the score based on the regression model predicting the difference. We have opted to develop models predicting the inspector ratings as the simpler and equally valid approach.

coefficient of multiple determination or what is more familiarly known as R^2. This can be interpreted as the percentage of variance around the mean which is explained by the model. We also present the multiple R, which is the square root of R^2 and is essentially the Pearson r between the predicted values estimated by the model and the actual data values. In order to ensure that effects due to mere random variance are not included in the models, we conducted F-tests of statistical significance for each of the individual predictors in the model. In addition, to assess the accuracy of the predictions made using these models, we determined the standard error of the estimates. This measures the average error we will experience using the models.

Predictor variables were selected on the basis of inductive and deductive considerations. For example, in addition to the results of a zero-order correlation analysis, we screened predictor variables on the basis of our expectations of logical relationships with physical house condition.

One of the major problems which can hinder a successful regression analysis is that of multicollinearity. This occurs when the independent variables are highly correlated with each other. In the extreme case of perfect correlation, it is not possible to determine the regression coefficients by least squares estimates since we cannot invert the correlation matrix. Even in the case of moderate collinearity (i.e., 0.6 to 0.8) standard errors of estimates will become artificially inflated and tolerance levels will be unacceptably low. As a rough rule, it is often assumed that when any two independent variables have a correlation greater than 0.5, it is unacceptable to use both in the same regression equation. A more stringent guideline is to not allow the inter-item correlation between any two predictors

to exceed the multiple R of the model. Overall, no problem with multicollinearity for the predictor variables exists.

In addition to the test for multicollinearity, we attempted to test the assumption of homoskedasticity (i.e., equal distribution of the error term). We plotted scatter diagrams relating predicted and actual values in order to determine whether or not the residuals had any systematic (non-random) form. In both analyses the residuals were found to be distributed randomly about the predicted regression lines.

The regression coefficients in the models can be interpreted as the average amount of change produced in the dependent variable by a one unit change in the independent variable. The regression effects are independent of the effects of all other terms in the regression model. It should be noted that for models with several independent terms (i.e., more than three), the values of the coefficients of individual terms should be interpreted cautiously because of the effects of the interaction of multiple terms. In other words, the overall explained variance of the model is valid but proportions of variance explained should not be attributed to individual variables. Fortunately this does not affect our immediate objective because our concern is with predictive power in a technical sense rather than with making causal inferences.

6.2 Regression Models for Owner-Occupied Buildings

The regression models used to predict the inspector ratings of exterior condition, interior condition, mechanical systems and overall condition are presented in this section. These summary indices (in their standardised forms) are the dependent variables predicted or variables used in the models.

The regression models for the four summary indices are presented in Exhibit 6.1 to 6.4. The models are presented first for exterior condition scores, followed by interior, mechanical systems and overall condition scores. For reasons explained at the end of Section 6.1, we have not been overly concerned with the specific terms of the models, therefore we have not presented a discussion of each one. Not surprisingly, the homeowner summary condition index is the term explaining the most variance for each model with the exception of the model for building interior, where building age was the term explaining the most variance.

It should be noted that in the computation of these models, dichotomous (i.e., dummy) variables for each of the five regions were included as independent terms. Including these regional variables was an attempt to statistically control for some of the significant regional variations in developing models applicable to the nation as a whole.

EXHIBIT 6.1
Regression Model Predicting Standardised Summary Rating for Exterior Condition

EXTSTD = 44.77922 + .72766 HOMEXT - .05036 BAGE + 7.80448 D5 + 5.78362 D6 + 5.147457E-05 INCOME + 3.70880 D3 + 2.30781 D1 + 1.41539 D2

where:

EXTSTD = summary rating for exterior of dwelling taken from the inspector questionnaire, standardised according to a scale of one to 100

HOMEXT = summary rating for exterior of dwelling taken from the homeowner questionnaire

BAGE = age of building in years

D5 = dummy variable for living in Ontario or not

D6 = dummy variable for living in Quebec or not

INCOME = total household income

D3 = dummy variable for living in British Columbia or not

D1 = dummy variable for regular maintenance only, either household requires maintenance or major/minor repairs

D2 = dummy variable for length of time in dwelling, ten years or less or qreater than ten years

NOTE:

EXTSTD =((EXSW1 + EXSW2 + EXSW3 + EXCW1 + EXCW3 + EXCW4 + EXCW5 + EXWD1 + EXRF2 + EXRF3 + EXRF4 + EXRF5 + EXGA1)/91)x100

HOMEXT = SITEWORK + OUTWALL + ROOF + CHIMNEY + DOORS + ATSTRUCT

EXHIBIT 6.1
CONTINUED

Correlation Matrix

	HOMEXT	BAGE	D5	D6	INCOME	D3	D1	D2
EXTSTD	.459	-.249	.178	.156	.200	.052	.357	.071
HOMEXT		-.157	.021	.074	.110	.012	.559	-.037
BAGE			-.005	-.047	-.043	-.076	-.201	-.147
D5				-.204	.085	-.146	.054	.041
D6					-.028	-.204	.021	-.056
INCOME						.002	.161	.032
D3							.044	.075
D1								.007

Summary Statistics

Independent Variable	Multiple R	R^2	R^2 Change	F	Standard Error	Beta
HOMEXT	.459	.210	.210	130.755	.06364	.35460
BAGE	.493	.243	.033	30.143	9.17324E-03	-.14563
D5	.521	.271	.028	58.745	1.01826	.20522
D6	.543	.295	.024	49.029	.82599	.18949
INCOME	.560	.313	.018	23.673	1.05796E-05	.12644
D3	.568	.323	.010	13.238	1.01934	.09753
D1	.573	.328	.005	8.006	.81562	.08885
D2	.575	.331	.003	4.133	.69622	.05285

EXHIBIT 6.2
Regression Model Predicting Standardised Summary Rating for Interior Condition

INTSTD = 58.43316 + 8.19332 D5 + .53719 HOMINT - .06188 BAGE - 8.71658 D4 + 6.297959E-05 INCOME - 4.03985 D7 + .80420 PRESENT + 2.52746 D1 + 2.27863 D2

where:

INTSTD = summary rating for interior of dwelling taken from the inspector questionnaire, standardised according to a scale of one to 100

D5 = dummy variable for living in Ontario or not

HOMINT = summary rating for interior of dwelling taken from the homeowner questionnaire

BAGE = age of building in years

D4 = dummy variable for living in Prairie region or not

INCOME = total household income

D7 = dummy variable for living in Atlantic region or not

PRESENT = quality of present neighbourhood facilities

D1 = dummy variable for regular maintenance only, either household requires maintenance or major/minor repairs

D2 = dummy variable for length of time in dwelling, ten years or less or greater than ten years

NOTE:

INTSTD =((INBA1 + INBA2 + INBA3 + INBA4 + INUF4 + INUF5A + INUF5B + INUF6 + INUF7 + INGA1A + INGA1B)/77)x100

HOMINT = FINCARP + FLOORING + DRYWALL + WALLSURF

EXHIBIT 6.2
CONTINUED

Correlation Matrix

	D5	HOMINT	BAGE	D4	INCOME	D7	PRESENT	D1	D2
INTSID	.330	.296	-.248	-.254	.203	-.180	.177	.273	.108
D5		.065	-.005	-.219	.085	-.236	.056	.054	.041
HOMINT			-.135	-.041	.081	-.092	.176	.457	-.042
BAGE				-.036	-.043	.139	-.048	-.201	-.147
D4					.104	-.354	.067	.022	.058
INCOME						-.141	.081	.161	.032
D7							-.164	-.114	-.090
PRESENT								.187	-.019
D1									.007

Summary Statistics

Independent Variable	Multiple R	R^2	R^2 Change	F	Standard Error	Beta
D5	.330	.109	.109	41.450	1.27262	.20689
HOMINT	.442	.195	.086	29.012	.09973	.17960
BAGE	.489	.239	.044	31.849	.01096	-.17181
D4	.522	.273	.034	72.286	1.02522	-.28457
INCOME	.549	.302	.029	24.465	1.27330E-05	.14856
D7	.565	.320	.018	16.054	1.00828	-.13679
PRESENT	.574	.329	.009	9.770	.23728	.09468
D1	.579	.336	.007	7.605	.91652	.09344
D2	.585	.342	.006	7.536	.83007	.08170

EXHIBIT 6.3
Regression Model Predicting Standardised Summary Rating for Mechanical Systems

MECSTD = 61.33529 - .07461 BAGE - 6.46757 D7 + .58946 D7 + 5.63372 D5 + 4.327794E-05 INCOME + 2.77398 D2 + 2.90864 D1 - 2.92697 D4

where:

MECSTD = summary rating for mechanical systems taken from the inspector questionnaire, standardised according to a scale of one to 100

BAGE = age of building in years

D7 = dummy variable for living in the Atlantic region or not

HOMMEC = summary rating for mechanical systems taken from the homeowner questionnaire

D5 = dummy variable for living in Ontario or not

INCOME = total household income

D2 = dummy variable for length of time in dwelling, ten years or less or greater than ten years

D1 = dummy variable for regular maintenance only, either household requires maintenance or major/ minor repairs

D4 = dummy variable for living in the Prairie region or not

NOTE:

MECSTD =((INBA6 + INMS1 + INMS2 + INMS3 + INMS6 + INMS7 + INMS8A + INMS8B + INMS10 + INMS11)/70)x100

HOMMEC = ELECTRIC + HEATING + PLUMBING + INSUL

EXHIBIT 6.3
CONTINUED

Correlation Matrix

	BAGE	D7	HOMEC	D5	INCOME	D2	D1	D4
MECSID	-.339	-.314	.332	.247	.206	.163	.298	-.035
BAGE		.139	-.221	-.005	-.043	-.147	-.201	-.036
D7			-.057	-.236	-.141	-.090	-.114	-.354
HOMEC				-.020	.152	-.009	.435	-.054
D5					.085	.041	.054	-.219
INCOME						.032	.161	.104
D2							.007	.075
D1								.022

Summary Statistics

Independent Variable	Multiple R	R^2	R^2 Change	F	Standard Error	Beta
BAGE	.339	.115	.115	75.837	8.56749E-03	-.22148
D7	.433	.188	.037	70.038	.77281	-.23412
HOMEC	.504	.254	.066	53.997	.08022	.20204
D5	.540	.291	.037	32.678	.98553	.15208
INCOME	.551	.303	.012	19.130	9.89494E-06	.10914
D2	.560	.313	.010	18.738	.64082	.10633
D1	.569	.323	.010	17.722	.69093	.11496
D4	.576	.331	.008	13.603	.79361	-.10215

EXHIBIT 6.4
Regression Model Predicting Standardised Summary Rating for Overall Condition

OVERSTD = 53.44748 + .24310 HOMALL + 6.88675 D5 - .08155 BAGE - 8.03629 D4 + 4.629812E-05 INCOME - 3.20862 D7 + .73984 PRESENT

where:

OVERSTD = summary rating for overall condition taken from the inspector questionnaire, standardised according to a scale of one to 100

HOMALL = summary rating for overall condition taken from the homeowner questionnaire

D5 = dummy variable for living in Ontario or not

BAGE = age of building in years

D4 = dummy variable for living in the Prairie region or not

INCOME = total household income

D7 = dummy variable for living in the Atlantic region or not

PRESENT = quality of present neighbourhood facilities

NOTE:

OVERSTD =((EXSW1 + EXSW2 + EXSW3 + EXCW1 + EXCW3 + EXCW4 + EXCW5 + EXWD1 + EXRF2 + EXRF3 + EXRF4 + EXRF5 + EXGA1 + INBA1 + INBA2 + INBA3 + INBA4 + INUF4 + INUF5A + INUF5B + INUF6 + INUF7 + INGA1A + INGA1B + OAGA1
+ INBA6 + INMS1 + INMS2 + INMS3 + INMS6 + INMS7 + INMS8A + INMS8B + INMS10 + INMS11)/245)x100

HOMALL = SITEWORK + OUTWALL + ROOF + CHIMNEY + DOORS + ATSTRUCT + FINCARP + FLOORING + DRYWALL + WALLSURF + ELECTRIC + HEATING + PLUMBING + INSUL

EXHIBIT 6.4
CONTINUED

Correlation Matrix

	HOMALL	D5	BAGE	D4	INCOME	D7	PRESENT
OVERSTD	.364	.299	-.309	-.265	.191	-.145	.172
HOMALL		.012	-.174	-.030	.195	-.063	.169
D5			-.005	-.219	.085	-.236	.056
BAGE				-.036	-.043	.139	-.048
D4					.104	-.354	.067
INCOME						-.141	.081
D7							-.164

Summary Statistics

Independent Variable	Multiple R	R^2	R^2 Change	F	Standard Error	Beta
HOMALL	.364	.132	.132	43.631	.03680	.26349
D5	.468	.219	.087	20.616	1.51676	.18915
BAGE	.530	.281	.062	40.010	.01289	-.24631
D4	.569	.323	.042	43.292	1.22139	-.28536
INCOME	.582	.339	.016	9.121	1.53302E-05	.11879
D7	.593	.352	.013	7.158	1.19932	-.11817
PRESENT	.600	.360	.008	5.882	.30506	.09474

A summary of the regression analysis results is presented in Exhibit 6.5. It presents a number of important pieces of information (for both the renovator and non-renovator models) including:

- o the r^2 of the regression models;
- o the square of the Pearson r correlation coefficients for the homeowner and inspector summary condition indices;
- o the difference between the square of the Pearson r coefficients and the r^2 of the regression models. This equals the absolute difference in variance explained by using the predicted score from the regression model instead of the homeowner score; and
- o the proportionate reduction in error resulting from the use of the predicted values from the regression models.

With the regression models, there is a substantial improvement over the homeowner ratings for all of the summary indices. In absolute terms, this improvement in explained variance varies from 11.4 per cent (for exterior condition) to 25.7 per cent (for interior condition). In proportionate terms, that is, the percentage improvement over the explained variance using the homeowner ratings, the improvements vary from 53 per cent (for exterior condition) to 302 per cent (for interior condition). The average absolute increase in explained variance is 20.6 per cent, while the average proportionate reduction in error is 191.7 per cent.

The procedures for applying the regression models to improve the condition ratings in the complete homeowner sample are relatively simple. Each regression model is used in compute-type statement to create a new variable in the SPSS system file or SAS file. Thus there will be four new

EXHIBIT 6.5
Summary of Results of Regression Analysis

	Exterior	Interior	Mechanical Systems	Overall
Regression r^2	.331	.342	.331	.360
Pearson r squared: homeowner/inspector summary ratings	.217	.085	.089	.150
Remainder (absolute difference in explained variance)	.114	.257	.242	.210
Proportionate reduction in error	53%	302%	272%	140%

variables; one for each of the four condition indices. These new variables will improve upon the homeowner ratings in the proportions presented in Exhibit 6.5. For example, to compute the new exterior condition index for renovators in the full homeowner sample, the SPSS computer statement would be as follows:

```
EXTCOND = 44.779 + .728 HOMEXT - .050 BAGE + 7.805 D5 +
          5.784 D6 + .000052 INCOME + 3.709 D3 + 2.308 D1 +
          1.415 D2
```

where: EXTCOND = the new exterior condition score
HOMEXT = the unstandardised homeowner summary rating of building exteior
BAGE = building age
D5 = dummy variable for Ontario
D6 = dummy variable for Quebec
INCOME = household income
D3 = dummy variable for British Columbia
D1 = dummy variable for regular maintenance
D2 = dummy variable for length of time in dwelling

Note: See Exhibit 6.1 for a full explanation of the regression model.

To work out an example for an individual case, let us assume that the unstandardised homeowner summary rating equals 37, the building is in British Columbia, is eight years old and the total household income is $20,000. The following calculations would then apply.

$$\begin{aligned} \text{EXTCOND} &= 44.779 + .728(37) - .050(8) + 7.805(0) + 5.784(0) \\ &\quad + .000052(20000) + 3.709(1) + 2.308(0) + 1.415(0) \\ &= 44.779 + 26.936 - 0.400 + 1.040 + 3.709 \\ &= 76.064 \\ &= 76.06 \end{aligned}$$

6.3 Comparison of Means for Inspector, Homeowner and Predicted Condition Scores

The regression results presented in Exhibits 6.1 through 6.5 provide a technical summary of the usefulness of the regression models for improving the validity of the homeowner condition ratings. Exhibits 6.6.A through 6.6.D present graphic comparisons of the mean scores for the inspector, homeowner and predicted ratings[1] for each of the four condition ratings. The purpose of these exhibits is to show that the predicted scores from the regression models are much closer to the standards (i.e., the inspector scores) than are the homeowner scores. In all cases the means of the predicted scores are almost identical to the means of the inspector scores.

The predicted scores presented in exhibits 6.6.A through 6.6.D will be most accurate for the level of analysis at which they were calculated (i.e., the national level). As the level of aggregation becomes smaller (e.g., the region, province or community) the level of error in the

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[1] The mean predicted inspector scores are calculated from the computed (i.e., predicted) scores based on the regression models.

prediction is likely to increase, primarily because the standard error (i.e., the average variation around the mean) will increase. This is a function of sampling and sample size.

We should note at this point that our regression analysis and the resulting predictive models (and predicted scores as presented in the following four exhibits) have been based only on the summary indices. In other words, the regression models apply to the summary indices for exterior, interior, mechanical systems and overall physical condition and not to the detailed set of physical condition items. However, it would be possible to extend the logic of this analysis and develop predictive models for the individual rating items. In order to develop the optimal models, it would be important to test a number of variables as independent terms and not just the ones presented in the final models resulting from our analysis.

EXHIBIT 6.6.A
Comparison of Means for Standardised Exterior Condition Scores

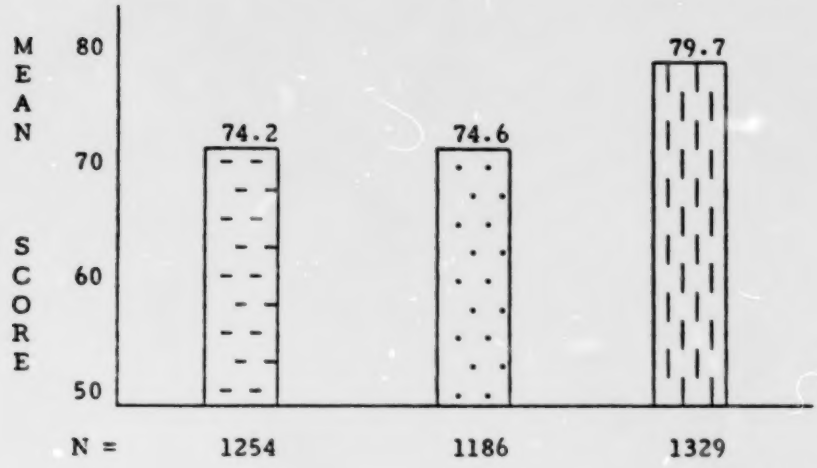
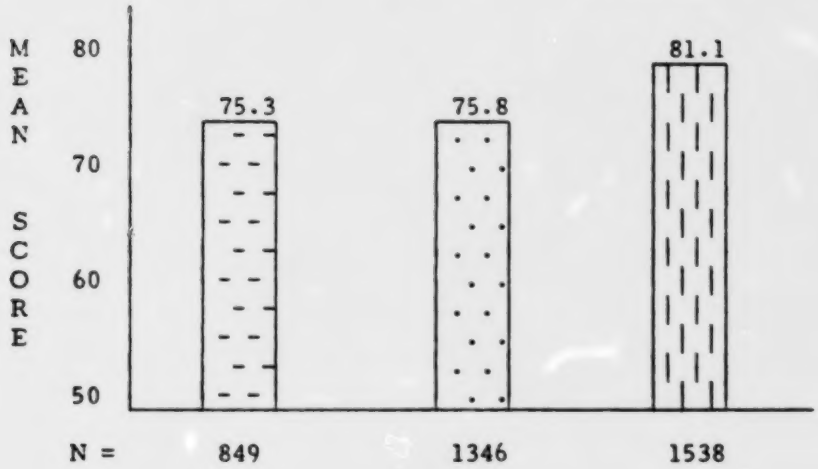


EXHIBIT 6.6.B
Comparison of Means for Standardised Interior Condition Scores



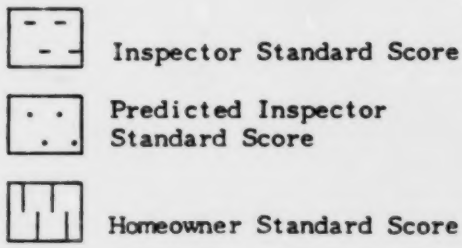


EXHIBIT 6.6.C
Comparison of Means for Standardised Mechanical Systems Condition Scores

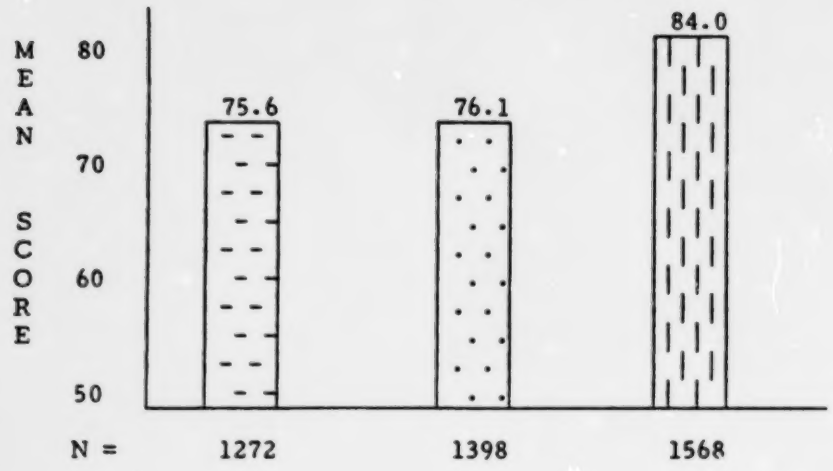
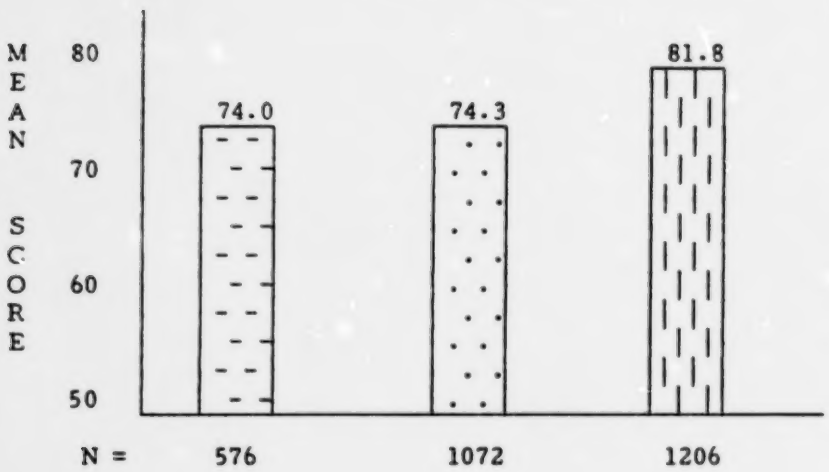


EXHIBIT 6.6.D
Comparison of Means for Standardised Overall Condition Scores



Inspector Standard Score

Predicted Inspector Standard Score

Homeowner Standard Score

7.0 SUMMARY AND CONCLUSIONS

The major objective of this study has been achieved. We have demonstrated that the validity of physical condition ratings of homeowners can be significantly improved upon by supplementing the homeowner ratings with information about dwelling and household characteristics. Regression analysis was used to improve the accuracy of the ratings from between 53 per cent and 302 per cent for owner-occupied dwellings. For a number of reasons, however, it was not possible to replicate this analysis for rental dwellings.

The analysis of sample characteristics demonstrated that the dwellings for which inspections were conducted were generally representative of the larger survey samples. For owner-occupied dwellings, the inspection sub-sample of almost 1,800 dwellings was very large and we can make our statements about data quality and survey error with precision and (statistical) confidence. However, for rental dwellings the inspection sub-sample of only 145 dwellings was much smaller. As a result, we could not conduct detailed analyses and cannot make statements about data quality with the same confidence.

The inspections data for owner-occupied dwellings are generally valid (i.e., the variables accurately represent what they are supposed to measure) and reliable (i.e., different inspectors got similar results with the instrument). One notable exception showed up during the detailed comparisons with homeowner condition ratings. There are statistically significant regional variables in the inspector condition ratings which, further analysis has led us to conclude, reflect reliability problems resulting from inconsistent use of the condition rating scales. As training was conducted regionally, we suspect that an

incomplete understanding of the method was the problem. In future we recommend that training sessions should include audio-visual presentations and/or field trips where dwellings can be rated and the ratings discussed in an open forum so that consensus and a common understanding can be achieved.

Although the regional differences are statistically significant and reflect an unacceptable source of error, to a large extent the problem has been overcome. Furthermore, through the use of statistical controls used in developing predictive models, this problem will not affect intra-regional analyses. With this method of statistical calibration the regression models have been calculated including covariates for each region[1]. These predictive models make adjustments for the variation attributable solely to the region of the dwelling.

The comparative analysis of condition data for rental dwellings was somewhat more problematic than for owner-occupied dwellings. The small number of cases and apparent validity and reliability problems for which we could not attribute a cause prevented us from developing models to improve tenant and landlord condition ratings.

We believe that the results of this analysis demonstrate that the inspections data can be used to make major improvements to the condition data for owner-occupied dwellings. The payoff will be more accurate estimates of repair need and repair costs. The problem with inadequate data for rental dwellings is unacceptable and should be addressed and the problem of regional differences for

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[1] The covariates would take the form of dummy or dichotomous variables (eg., yes/no) for each region. One term would be required for each region (e.g., Variable D1: Atlantic = 1, not Atlantic = 0; Variable D2: Quebec = 1, not Quebec = 0, etc..)

inspector ratings of owner-occupied dwellings merits further examination. However, they should not overshadow the large and immediate benefit that can be gained by applying the results of this analysis.

One final conclusion concerns the analysis of the categorical need for repair question. The analysis of this data was not part of the terms of reference of this study. However, we believe that such an analysis should be an urgent priority for CMHC. Not only is the comparative analysis of the survey and inspections data on the need for repair question justified on its own, our work has led us to conclude that a comparative analysis of the detailed interval-level condition data and the categorical need for repair data would greatly enhance the value of both types of measures.

APPENDIX A.1

Comparison of National Housing Study Characteristics and CMHC Inspector Data Characteristics-Homeowners

	NHS	CMHC Inspector
Language		
English	82.1%	77.8%
French	17.9%	22.2%
	n=8972	n=1726
Type of building		
Single detached	88.1%	89.8%
Other	11.9%	10.2%
	n=8820	n=1709
How long lived there		
Less than 1 year	5.5%	5.7%
One to two years	8.5%	9.1%
Two to five years	18.7%	19.6%
Five to ten years	23.4%	23.7%
Ten to twenty years	23.4%	23.1%
More than twenty years	20.5%	18.8%
	n=8815	n=1703
Building in need of repair		
Yes - major repairs	9.5%	13.7%
Yes - minor repairs	21.4%	23.5%
No - regular maintenance	69.2%	62.8%
	n=8662	n=1670
Do any renovation work in 1985?		
Yes	50.0%	55.9%
No work done	50.0%	44.1%
	n=8583	n=1662
Description of Household		
One person alone	7.4%	6.2%
One adult with children	4.3%	4.0%
Married no children	23.1%	23.1%
Married with children	60.8%	63.3%
Two or more unrelated adults	0.9%	0.7%
Other	3.5%	2.7%
	n=8690	n=1683
Education		
Primary school	12.4%	11.1%
High school	43.2%	39.7%
Some college	9.5%	9.5%
College graduate	9.9%	10.3%
Some university	9.0%	11.2%
University graduate	10.4%	12.2%
Post graduate	5.5%	6.0%
	n=8477	n=1638

Comparison of National Housing Study Characteristics and CMHC Inspector Data Characteristics-Homeowners Continued

	NHS	CMHC Inspector
Occupation		
Farming, Fishing	6.3%	5.4%
Labourer	6.8%	6.4%
Semi-skilled	5.9%	6.4%
Skilled trade	12.1%	13.6%
Sales and service	14.9%	13.9%
Professional	18.1%	19.8%
Managerial	14.2%	16.9%
Homemaker	15.7%	12.2%
Other	5.9%	5.3%
	n=8310	n=1615
Employment Status		
Self-employed	12.3%	12.5%
Full-time	47.8%	48.0%
Part-time	11.8%	11.4%
Unemployed	7.0%	6.2%
Student	0.7%	0.7%
Retired	16.2%	17.4%
Other	4.1%	3.7%
	n=8390	n=1643
Province		
Alberta	11.7%	11.9%
British Columbia	16.4%	12.7%
Manitoba	6.4%	5.9%
New Brunswick	7.5%	7.1%
Newfoundland	5.4%	6.2%
Nova Scotia	9.5%	11.1%
Ontario	16.0%	12.7%
Prince Edward Island	3.0%	3.3%
Quebec	17.9%	22.2%
Saskatchewan	6.3%	7.0%
	n=8972	n=1726
Number of rooms in dwelling	$\bar{x}$=6.91	$\bar{x}$=7.01
	n=8908	n=1715

Comparison of National Housing Study Characteristics and CMHC Inspector Data Characteristics-Homeowners Continued

	NHS	CMHC Inspector
Age of dwelling	$\bar{x}$=28.64 n=8549	$\bar{x}$=29.27 n=1660
Age of respondent	$\bar{x}$=45.5 n=8690	$\bar{x}$=45.9 n=1687
Selling price of dwelling	$\bar{x}$=$82,120.19 n=8125	$\bar{x}$=$80,034.63 n=1647
Household income	$\bar{x}$=$38,006.35 n=7287	$\bar{x}$=$37,660.33 n=1561

APPENDIX A.2

Comparison of Characteristics between the CMHC National Study and the Inspector Data-Landlords

	NHS	CMHC Inspector
Language		
English	68.2%	69.7%
French	31.8%	30.3%
	n=977	n=145
Type of building		
Single detached	29.8%	21.7%
Other	70.2%	78.3%
	n=950	n=143
Building in need of repair		
Yes - major repairs	10.7%	12.1%
Yes - minor repairs	23.2%	22.7%
No - regular maintenance	66.0%	65.2%
	n=942	n=141
Who owns building		
Private corporation	17.0%	21.0%
Private individual	56.0%	53.1%
2 or more private individuals	22.2%	20.3%
Other	4.8%	5.6%
	n=952	n=143
Any renovation done in 1985?		
Yes	59.7%	63.5%
No work done	40.3%	36.5%
	n=913	n=137
Occupation		
Farming, Fishing	4.3%	3.1%
Labourer	7.9%	3.1%
Semi-skilled	7.1%	8.5%
Skilled trade	11.3%	10.9%
Sales and service	10.8%	9.3%
Professional	18.2%	20.9%
Managerial	21.6%	28.7%
Homemaker	6.3%	3.9%
Other	12.6%	11.6%
	n=890	n=129
Have an outstanding mortgage		
Yes	62.5%	71.8%
No	27.5%	28.2%
	n=928	n=142

Comparison of Characteristics between the CMHC National Study and the Inspector Data-Landlords Continued

	NHS	CMHC Inspector
Province		
Alberta	9.8%	9.7%
British Columbia	12.9%	11.7%
Manitoba	4.6%	4.1%
New Brunswick	6.3%	2.8%
Newfoundland	1.9%	2.1%
Nova Scotia	8.4%	8.3%
Ontario	15.4%	18.6%
Prince Edward Island	3.5%	5.5%
Quebec	32.5%	30.3%
Saskatchewan	4.6%	6.9%
	n=977	n=145
Number of units in building	$\bar{x}$=14.01 n=924	$\bar{x}$=17.33 n=142
Number of years owned the building	$\bar{x}$=11.05 n=907	$\bar{x}$=9.32 n=143
Age of building	$\bar{x}$=35.39 n=907	$\bar{x}$=31.00 n=137
Selling price of dwelling	$\bar{x}$=$420,104.72 n=786	$\bar{x}$=$620,262.19 n=123
Percentage of assets building represents	$\bar{x}$=44.42% n=666	$\bar{x}$=43.16% n=104

APPENDIX A.3

Comparison of Characteristics of CMHC National Housing Study and CMHC Inspector Data-Tenants

	NHS	CMHC Inspector
Language		
English	71.3%	65.6%
French	28.7%	34.4%
	n=2568	n=93
How long lived there		
Less than 1 year	23.1%	22.2%
One to two years	25.5%	32.2%
Two to five years	28.5%	24.4%
Five to ten years	12.9%	11.1%
Ten to twenty years	6.9%	7.8%
More than twenty years	3.1%	2.2%
	n=2524	n=90
Building in need of repair		
Yes - major repairs	12.2%	8.0%
Yes - minor repairs	32.8%	18.4%
No - regular maintenance	55.0%	73.6%
	n=2400	n=87
Any renovation done in 1985?		
Yes	23.2%	13.8%
No work done	76.8%	86.2%
	n=2427	n=87
Description of Household		
One person alone	25.5%	18.7%
One adult with children	9.5%	16.5%
Married no children	22.6%	19.8%
Married with children	31.4%	36.3%
Two or more unrelated	6.0%	4.4%
Other	5.0%	4.4%
	n=2491	n=91
Education		
Primary school	7.1%	11.1%
High school	41.3%	33.3%
Some college	12.3%	13.3%
College graduate	12.6%	11.1%
Some university	9.9%	13.3%
University graduate	11.9%	14.4%
Post graduate	4.9%	3.3%
	n=2415	n=90

Comparison of Characteristics of CMHC National Housing Study and CMHC Inspector Data-Tenants Continued

	NHS	CMHC Inspector
Occupation		
Farming, Fishing	2.0%	2.2%
Labourer	8.7%	14.4%
Semi-skilled	5.6%	2.2%
Skilled trade	7.7%	6.7%
Sales and service	21.9%	13.3%
Professional	19.4%	23.3%
Managerial	10.0%	11.1%
Homemaker	14.5%	14.4%
Other	10.0%	12.2%
	n=2403	n=90
Employment Status		
Self-employed	5.8%	5.8%
Full-time	53.9%	54.7%
Part-time	11.7%	9.3%
Unemployed	10.9%	10.5%
Student	5.1%	5.8%
Retired	7.7%	9.3%
Other	4.9%	4.7%
	n=2367	n=86
Province		
Alberta	10.9%	5.4%
British Columbia	18.8%	12.9%
Manitoba	4.6%	3.2%
New Brunswick	4.6%	2.2%
Newfoundland	1.9%	1.1%
Nova Scotia	6.6%	8.6%
Ontario	14.3%	19.4%
Prince Edward Island	2.5%	6.5%
Quebec	31.1%	33.3%
Saskatchewan	4.8%	7.5%
	n=2568	n=93
Number of rooms in dwelling	$\bar{x}$=4.80	$\bar{x}$=4.68
	n=2546	n=90

Comparison of Characteristics of CMHC National Housing Study and CMHC Inspector Data-Tenants Continued

	NHS	CMHC Inspector
Age of Tenant	$\bar{x}$=35.47 n=2444	$\bar{x}$=35.74 n=86
Monthly rent	$\bar{x}$=$389.07 n=2395	$\bar{x}$=$358.87 n=86
Household income	$\bar{x}$=$25,173.50 n=1768	$\bar{x}$=$25.066.74 n=61

APPENDIX B.1.A

Pearson r Coefficients for Correlations Between Landlord and Tenant Exterior Condition Ratings and Appropriate Inspector Ratings: Single, Semi-Detached, Row and Duplex Buildings Only

Landlord/Tenant	Inspector		
	Surface Drainage (Q.9)	Lot (Q.10)	
Sitework-landlord	.198	.361	
	Foundation Walls (Q.11)	Surface Ext. Walls (Q.13)	Structure Ext. Walls (Q.14)
Outside walls-landlord	.057	.359	.331
	Roof Surface (Q.18)	Roof Structure (Q.19)	Flashing (Q.20)
Roof-landlord	.283	.213	.271
	Chimney (Q.15)		
Chimney-landlord	.370		
	Doors and Windows (Q.16)		
Doors, Windows-landlord	.280		
	Attached Structures (Q.8)		
Attached structures-landlord	.361		
	Overall Exterior (Q.22)		
Overall exterior-tenant	.267		

Pearson r Coefficients for Correlations Between Landlord and Tenant Interior Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector		
	Surface of Floors (Q.43)	Structural Grd. Floor (Q.44a)	Structural All Floors (Q.44b)
Flooring-landlord	.150	.044	-.055
-tenant	.216	-.028	-.056

Pearson r Coefficients for Correlations Between Landlord and Tenant Mechanical System Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector	
	Wiring (Q.34)	Electrical System (Q.35)
Electrical-landlord	.216	.107
-tenant	.240	.137
	Furnace (Q.38)	Heat Distribution System (Q.31)
Heating/Cooling		
- landlord	-.071	.091
- tenant	.201	.403

	Water Supply System (Q.36a)	Plumbing (Q.36b)	Bathroom Equipment (Q.38)
Plumbing-landlord	.149	.128	.027
-tenant	.092	.159	-.008

	Insulation Package (Q.28)
Insulation-landlord	.247
-tenant	.367

APPENDIX B.1.B

Pearson r Coefficients for Correlations Between Landlord and Tenant Exterior Condition Ratings and Appropriate Inspector Ratings: Apartments (and other buildings) Only

Landlord/Tenant	Inspector		
	Surface Drainage (Q.9)	Lot (Q.10)	
Sitework-landlord	.092	.108	
	Foundation Walls (Q.11)	Surface Ext. Walls (Q.13)	Structure Ext. Walls (Q.14)
Outside walls-landlord	.139	.315	.280
	Roof Surface (Q.18)	Roof Structure (Q.19)	Flashing (Q.20)
Roof-landlord	.280	.204	.092
	Chimney (Q.15)		
Chimney-landlord	.343		
	Doors and Windows (Q.16)		
Doors, Windows-landlord	.136		
	Attached Structures (Q.8)		
Attached structures-landlord	.230		
	Overall Exterior (Q.22)		
Overall exterior-tenant	.122		

Pearson r Coefficients for Correlations Between Landlord and Tenant Interior Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector		
	Surface of Floors (Q.43)	Structural Grd. Floor (Q.44a)	Structural All Floors (Q.44b)
Flooring-landlord	.065	.036	.109
-tenant	.144	.181	.103

Pearson r Coefficients for Correlations Between Landlord and Tenant Mechanical System Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector	
	Wiring (Q.34)	Electrical System (Q.35)
Electrical-landlord	.058	-.064
-tenant	.045	-.071
	Furnace (Q.38)	Heat Distribution System (Q.31)
Heating/Cooling - landlord	.407	.173
- tenant	-.384	-.221

	Water Supply System (Q.36a)	Plumbing (Q.36b)	Bathroom Equipment (Q.38)
Plumbing-landlord	.081	.067	.213
-tenant	.163	.186	.179

	Insulation Package (Q.28)
Insulation-landlord	.148
-tenant	-.094

APPENDIX B.2.A

Pearson r Coefficients for Correlations Between Landlord and Tenant Exterior Condition Ratings and Appropriate Inspector Ratings: Tenure of More Than Two Years

Landlord/Tenant	Inspector		
	Surface Drainage (Q.9)	Lot (Q.10)	
Sitework-landlord	.290	.263	
	Foundation Walls (Q.11)	Surface Ext. Walls (Q.13)	Structure Ext. Walls (Q.14)
Outside walls-landlord	.125	.275	.435
	Roof Surface (Q.18)	Roof Structure (Q.19)	Flashing (Q.20)
Roof-landlord	.519	.284	.298
	Chimney (Q.15)		
Chimney-landlord	.555		
	Doors and Windows (Q.16)		
Doors, Windows-landlord	.202		
	Attached Structures (Q.8)		
Attached structures-landlord	.539		
	Overall Exterior (Q.22)		
Overall exterior-tenant	.229		

Pearson r Coefficients for Correlations Between Landlord and Tenant Interior Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector		
	Surface of Floors (Q.43)	Structural Grd. Floor (Q.44a)	Structural All Floors (Q.44b)
Flooring-landlord	.192	.001	-.147
-tenant	.401	.085	.000

Pearson r Coefficients for Correlations Between Landlord and Tenant Mechanical System Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector	
	Wiring (Q.34)	Electrical System (Q.35)
Electrical-landlord	.407	.192
-tenant	.219	.208
	Furnace (Q.38)	Heat Distribution System (Q.31)
Heating/Cooling - landlord	.042	.282
- tenant	-.022	.118

	Water Supply System (Q.36a)	Plumbing (Q.36b)	Bathroom Equipment (Q.38)
Plumbing-landlord	.362	.237	.123
-tenant	.120	.070	.120

	Insulation Package (Q.28)
Insulation-landlord	.184
-tenant	.306

APPENDIX B.2.B

Pearson r Coefficients for Correlations Between Landlord and Tenant Exterior Condition Ratings and Appropriate Inspector Ratings: Tenure of Less Than Two Years

Landlord/Tenant	Inspector		
	Surface Drainage (Q.9)	Lot (Q.10)	
Sitework-landlord	.208	.120	
	Foundation Walls (Q.11)	Surface Ext. Walls (Q.13)	Structure Ext. Walls (Q.14)
Outside walls-landlord	.053	.419	.322
	Roof Surface (Q.18)	Roof Structure (Q.19)	Flashing (Q.20)
Roof-landlord	.331	.314	.197
	Chimney (Q.15)		
Chimney-landlord	.367		
	Doors and Windows (Q.16)		
Doors, Windows-landlord	.201		
	Attached Structures (Q.8)		
Attached structures-landlord	-.103		
	Overall Exterior (Q.22)		
Overall exterior-tenant	.178		

Pearson r Coefficients for Correlations Between Landlord and Tenant Interior Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector		
	Surface of Floors (Q.43)	Structural Grd. Floor (Q.44a)	Structural All Floors (Q.44b)
Flooring-landlord	.040	-.077	-.059
-tenant	-.062	.079	-.011

Pearson r Coefficients for Correlations Between Landlord and Tenant Mechanical System Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector	
	Wiring (Q.34)	Electrical System (Q.35)
Electrical-landlord	.012	-.001
-tenant	.109	-.059
	Furnace (Q.38)	Heat Distribution System (Q.31)
Heating/Cooling		
- landlord	-.110	.028
- tenant	-.071	.128

	Water Supply System (Q.36a)	Plumbing (Q.36b)	Bathroom Equipment (Q.38)
Plumbing-landlord	-.090	.023	.113
-tenant	.102	.163	.007

	Insulation Package (Q.28)
Insulation-landlord	.101
-tenant	.094

APPENDIX B.3.A

Pearson r Coefficients for Correlations Between Landlord and Tenant Exterior Condition Ratings and Appropriate Inspector Ratings: Cases with Matching Landlord and Tenant Data

Landlord/Tenant	Inspector		
	Surface Drainage (Q.9)	Lot (Q.10)	
Sitework-landlord	.255	.189	
	Foundation Walls (Q.11)	Surface Ext. Walls (Q.13)	Structure Ext. Walls (Q.14)
Outside walls-landlord	.115	.377	.392
	Roof Surface (Q.18)	Roof Structure (Q.19)	Flashing (Q.20)
Roof-landlord	.386	.273	.243
	Chimney (Q.15)		
Chimney-landlord	.410		
	Doors and Windows (Q.16)		
Doors, Windows-landlord	.201		
	Attached Structures (Q.8)		
Attached structures-landlord	.274		
	Overall Exterior (Q.22)		
Overall exterior-tenant	.212		

Pearson r Coefficients for Correlations Between Landlord and Tenant Interior Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector		
	Surface of Floors (Q.43)	Structural Grd. Floor (Q.44a)	Structural All Floors (Q.44b)
Flooring-landlord	.107	-.050	-.119
-tenant	.184	.079	.021

Pearson r Coefficients for Correlations Between Landlord and Tenant Mechanical System Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector	
	Wiring (Q.34)	Electrical System (Q.35)
Electrical-landlord	.180	.084
-tenant	.167	.068
	Furnace (Q.38)	Heat Distribution System (Q.31)
Heating/Cooling		
- landlord	.017	.121
- tenant	-.026	.168

	Water Supply System (Q.36a)	Plumbing (Q.36b)	Bathroom Equipment (Q.38)
Plumbing-landlord	.160	.132	.136
-tenant	.122	.172	.092

	Insulation Package (Q.28)
Insulation-landlord	.114
-tenant	.190

APPENDIX B.3.B

Pearson r Coefficients for Correlations Between Landlord and Tenant Exterior Condition Ratings and Appropriate Inspector Ratings: Cases with Landlord Data Only

Landlord/Tenant	Inspector		
	Surface Drainage (Q.9)	Lot (Q.10)	
Sitework-landlord	.002	.198	
	Foundation Walls (Q.11)	Surface Ext. Walls (Q.13)	Structure Ext. Walls (Q.14)
Outside walls-landlord	.063	.147	.101
	Roof Surface (Q.18)	Roof Structure (Q.19)	Flashing (Q.20)
Roof-landlord	.044	.100	.029
	Chimney (Q.15)		
Chimney-landlord	.313		
	Doors and Windows (Q.16)		
Doors, Windows-landlord	.203		
	Attached Structures (Q.8)		
Attached structures-landlord	.208		
	Overall Exterior (Q.22)		
Overall exterior-tenant	--		

Pearson r Coefficients for Correlations Between Landlord and Tenant Interior Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector		
	Surface of Floors (Q.43)	Structural Grd. Floor (Q.44a)	Structural All Floors (Q.44b)
Flooring-landlord	.109	.172	.248
-tenant	--	--	--

Pearson r Coefficients for Correlations Between Landlord and Tenant Mechanical System Condition Ratings and Appropriate Inspector Ratings

Landlord/Tenant	Inspector	
	Wiring (Q.34)	Electrical System (Q.35)
Electrical-landlord	.083	-.061
-tenant	--	--
	Furnace (Q.38)	Heat Distribution System (Q.31)
Heating/Cooling - landlord	.383	.204
- tenant	--	--

	Water Supply System (Q.36a)	Plumbing (Q.36b)	Bathroom Equipment (Q.38)
Plumbing-landlord	.030	.016	.144
-tenant	--	--	--

	Insulation Package (Q.28)
Insulation-landlord	.296
-tenant	--

APPENDIX C.1

RENOVATORS

Summary of Difference Scores for Owner-Occupied Buildings: Exterior Condition

Region	Mean Score	n
Atlantic	-7.70	123
British Columbia	-2.99	96
Ontario	-1.69	82
Quebec	-2.81	110
Prairies	-8.73	173
Need for Repair		
Yes -- major repairs	-1.41	63
Yes -- minor repairs	-0.50	122
No -- regular maintenance	-7.66	389
Language		
English	-6.20	472
French	-2.38	112

Summary of Difference Scores for Owner-Occupied Buildings: Interior Condition

Region		
Atlantic	-9.15	134
British Columbia	-0.71	51
Ontario	2.99	95
Quebec	-6.63	61
Prairies	-8.24	126
Need for Repair		
Yes -- major repairs	0.66	58
Yes -- minor repairs	-3.14	87
No -- regular maintenance	-6.80	313

Summary of Difference Scores for Owner-Occupied Buildings: Mechancial Systems Condition

Region		
Atlantic	-13.73	136
British Columbia	-2.67	89
Ontario	-0.84	106
Quebec	-6.98	108
Prairies	-6.93	225
Need for Repair		
Yes -- major repairs	3.09	65
Yes -- minor repairs	-4.65	153
No -- regular maintenance	-9.02	431

Summary of Difference Scores for Owner-Occupied Buildings: Overall Condition

Region	Mean Score	n
Atlantic	-10.24	56
British Columbia	-2.34	36
Ontario	-1.75	54
Quebec	-8.32	28
Prairies	-9.55	95
Need for Repair		
Yes -- major repairs	-1.04	30
Yes -- minor repairs	-3.65	46
No -- regular maintenance	-8.79	188

APPENDIX C.2

NON-RENOVATORS

Summary of Difference Scores for Owner-Occupied Buildings: Exterior Condition

Region	Mean Score	n
Atlantic	-8.72	109
British Columbia	-6.69	68
Ontario	1.10	45
Quebec	-4.98	103
Prairies	-8.62	93
Need for Repair		
Yes -- major repairs	5.52	50
Yes -- minor repairs	-3.33	88
No -- regular maintenance	-9.60	272
Employment Status		
Self-employed	-10.64	52
Full-time	-5.13	191
Part-time	-4.52	40
Unemployed	-0.45	22
Student	-4.63	4
Retired	-8.40	80
Other	-10.14	11

Summary of Difference Scores for Owner-Occupied Buildings: Interior Condition

Region		
Atlantic	-7.65	83
British Columbia	-2.80	37
Ontario	3.23	48
Quebec	-10.02	56
Prairies	-11.59	70
Need for Repair		
Yes -- major repairs	3.42	34
Yes -- minor repairs	-3.33	65
No -- regular maintenance	-9.63	190
Language		
English	-5.75	236
French	-10.34	58

Summary of Difference Scores for Owner-Occupied Buildings: Mechanical Systems Condition

Region	Mean Score	n
Atlantic	-11.48	113
British Columbia	-6.24	69
Ontario	1.19	61
Quebec	-10.11	95
Prairies	-9.05	134
Need for Repair		
Yes -- major repairs	-0.71	70
Yes -- minor repairs	-5.66	102
No -- regular maintenance	-11.03	282

Summary of Differences for Owner-Occupied Buildings: Overall Condition

Region		
Atlantic	-10.15	40
British Columbia	-5.43	28
Ontario	0.12	28
Quebec	-8.94	25
Prairies	-12.86	49
Need for Repair		
Yes -- major repairs	9.35	20
Yes -- minor repairs	-7.45	29
No -- regular maintenance	-11.52	119

APPENDIX D.1

Sample Page from the National Housing Study Homeowner Questionnaire Showing Summary Scale Components

13.a) **Please rate the dwelling's general physical condition by circling the appropriate number on each of the following scales. If you are unsure about the condition rating please circle number 9.**

		BEYOND REPAIR			MINIMUM ACCEPTABLE		PERFECT CONDITION		DON'T KNOW
1	Sitework (e.g., driveway, plantings, fencing)	1	2	3	4	5	6	7	9
	Outside Walls	1	2	3	4	5	6	7	9
	Roof (e.g., gutters, downspouts, shingles)	1	2	3	4	5	6	7	9
	Chimney	1	2	3	4	5	6	7	9
	Doors, Windows	1	2	3	4	5	6	7	9
	Attached Structures (e.g., steps, porches)	1	2	3	4	5	6	7	9
2	Finished Carpentry (e.g., doors, shelves, cabinets)	1	2	3	4	5	6	7	9
	Flooring (e.g., hardwood, carpet, tile)	1	2	3	4	5	6	7	9
	Drywall/Plaster	1	2	3	4	5	6	7	9
	Wall Surfaces (e.g., paint, paper, tiling)	1	2	3	4	5	6	7	9
3	Electrical (e.g., lighting fixtures, wiring etc.)	1	2	3	4	5	6	7	9
	Heating/Cooling (e.g., furnace, baseboard radiators, fireplace, ductwork)	1	2	3	4	5	6	7	9
	Plumbing (e.g., pipes, fixtures) .	1	2	3	4	5	6	7	9
	Insulation (e.g., attic, walls, doors, windows)	1	2	3	4	5	6	7	9
	Other (Please specify) _____								
	_____ ...	1	2	3	4	5	6	7	9

1. Exterior Summary Scale Components
2. Interior Summary Scale Components
3. Mechanical System Summary Scale Components

APPENDIX D.2

Sample Page from the National Housing Study
Landlord Questionnaire
Showing Summary Scale Components

10.a) **Please rate the building's general physical condition by circling the appropriate number on the scale. Consider all units and provide average ratings for the building as a whole.**

		BEYOND REPAIR			MINIMUM ACCEPTABLE		PERFECT CONDITION		DON'T KNOW
1	Sitework (e.g., driveway, plantings, fencing)	1	2	3	4	5	6	7	9
	Outside Walls	1	2	3	4	5	6	7	9
	Roof (e.g., gutters, downspouts, shingles)	1	2	3	4	5	6	7	9
	Chimney	1	2	3	4	5	6	7	9
	Doors, Windows	1	2	3	4	5	6	7	9
	Attached Structures (e.g., steps, porches)	1	2	3	4	5	6	7	9
2	Finished Carpentry (e.g., doors, shelves, cabinets)	1	2	3	4	5	6	7	9
	Flooring (e.g., hardwood, carpet, tile)	1	2	3	4	5	6	7	9
	Drywall/Plaster	1	2	3	4	5	6	7	9
	Wall Surfaces (e.g., paint, paper, tiling)	1	2	3	4	5	6	7	9
3	Electrical (e.g., lighting fixtures, wiring etc.)	1	2	3	4	5	6	7	9
	Heating/Cooling (e.g., furnace, baseboard radiators, fireplace, ductwork)	1	2	3	4	5	6	7	9
	Plumbing (e.g., pipes, fixtures) .	1	2	3	4	5	6	7	9
	Insulation (e.g., attic, walls, doors, windows)	1	2	3	4	5	6	7	9
	Other (Please specify) _____								
	_____ ...	1	2	3	4	5	6	7	9

1. Exterior Summary Scale Components
2. Interior Summary Scale Components
3. Mechanical System Summary Scale Components

APPENDIX D.3

Sample Page from NHS Tenant Questionnaire
Showing Summary Scale Components

THE FOLLOWING QUESTIONS DEAL WITH THE CONDITION OF DIFFERENT ASPECTS OF YOUR DWELLING AND ANY RENOVATION WORK THAT YOU MIGHT HAVE DONE OR PLAN TO DO.

9.a) **Please rate your dwelling unit's general condition by circling the appropriate number on each of the following scales.** If you are unsure about the condition rating, please circle number 9.

		BEYOND REPAIR			MINIMUM ACCEPTABLE			PERFECT CONDITION
1	Finished Carpentry (e.g., doors, shelves, cabinets)	1	2	3	4	5	6	7
1	Flooring (e.g., hardwood, carpet, tile)	1	2	3	4	5	6	7
1	Drywall/Plaster	1	2	3	4	5	6	7
1	Wall Surfaces (e.g., paint, paper, tiling)	1	2	3	4	5	6	7
2	Electrical (e.g., lighting fixtures, wiring, etc.)	1	2	3	4	5	6	7
2	Heating/Cooling (e.g., furnace, baseboard radiators, fireplace, duct work)	1	2	3	4	5	6	7
2	Plumbing (e.g., pipes, fixtures)	1	2	3	4	5	6	7
2	Insulation (e.g., attic, walls, doors, windows)	1	2	3	4	5	6	7
	Other (Please specify) _____	1	2	3	4	5	6	7

1. Interior Summary Scale Components
2. Mechanical System Summary Scale Components

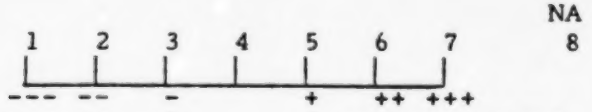
APPENDIX D.4

Sample of the Scales from the Inspector Instrument

Sample of the Scales from the Inspector Instrument

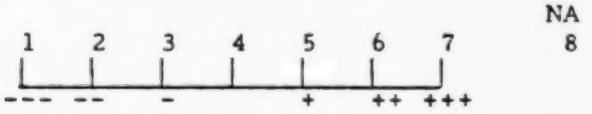
20. E X R F 4 ⌊__⌋

On the basis of a visual inspection, rate the condition of the flashing (e.g., in terms of evidence of waterproofness, wear, corrosion, etc.).



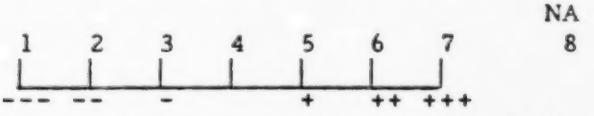
21. E X R F 5 ⌊__⌋

Provide a rating of the soffits and fascia and attic ventilation on the basis of a visual examination (e.g., in terms of deterioration, sagging, rotting, severe peeling of paint, missing pieces, etc.).



48. I N G A 1 A ⌊__⌋

a) On the basis of your inspection of interior walls, ceilings, floors and stairs of this dwelling unit, how would you rate their overall condition regarding surface considerations?



49. O A G A 1 ⌊__⌋

How would you rate the overall condition of this building on the basis of your inspection of the exterior and interior both structural and surface conditions?